

weight, to become heated so rapidly as to produce a decided chinook; consequently, during the current December Mr. B. S. Pague, Section Director for Oregon, reports that—

The month was generally warmer than usual, that in fact it was abnormal so far as the absence of any extreme cold is concerned. Two well-defined chinooks were experienced; viz, from the 5th to the 8th and from the 26th to the 28th.

These dates correspond to those of the warm winds on the eastern slope, showing that the same area of descending air can produce chinooks on both sides of the Plateau Region. Mr. Pague says:

The cause of the mild temperature throughout the month was the dynamic heating of the air, due to the high pressures over the Plateau Region and the high latitude in which the low pressures passed from the ocean eastward. Had the high pressures been persistent to the north of Montana, then they would not have been over the Plateau Region, and the result would have been different; the low pressures would have traveled south of the normal path, and the cold air from the northeast would have lowered the temperatures much below the normal.

If the dry air from the Plateau Region descends with sufficient slowness it may cool by radiation rapidly enough to counterbalance the warming by compression. This latter warming is quite an exact quantity and amounts to about 1°

C. for every 100 meters of descent, or to 1° F. for every 183 feet, consequently air that has descended 5,500 feet vertically must have been warmed up 30° F. Now, clear, dry air, rolling along on the surface of frozen or snow-covered ground in the winter season when the sun is low, can easily cool more than 30° in twenty-four hours. Thus, northerly winds and cold weather in Texas may sometimes be a direct continuation of air that was quite warm when it rapidly descended the eastern slope of the Rocky Mountains a few days before in Montana, Nebraska, or Kausas. But most frequently the cold waves of Texas are due to the southward flow of cold air from the Canadian regions into the Mississippi watershed; the divide between the Mississippi and Canada is scarcely 2,000 feet above sea level and the cold air generally lies below the 3,000-foot contour line. The progress of such a cold wave, south and east, is frequently described as dense air underflowing, pushing aside, and lifting up the warmer, lighter air of the Mississippi Valley. Above this cold air the observers on mountain tops and plateaus, or in balloons, generally find air that is potentially warmer, that is to say, air that if brought down to the earth's surface would by compression have a higher temperature than the air of the cold wave.

### METEOROLOGICAL TABLES AND CHARTS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only the 8 p. m. observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation; the altitudes of the instruments, the total depth of snowfall, and the mean wet-bulb temperatures are now given.

Table II gives, for about 2,400 stations occupied by voluntary observers, the extreme maximum and minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for about 30 Canadian stations, the mean pressure, mean temperature, total precipitation, prevailing wind, total depth of snowfall, and the respective departures from normal values. Reports from Newfoundland and Bermuda are included in this table for convenience of tabulation.

Table IV gives detailed observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, meteorologist to the Government Survey.

Table V gives, for 26 stations, the mean hourly temperatures deduced from thermographs of the pattern described and figured in the Report of the Chief of the Weather Bureau, 1891-92, p. 29.

Table VI gives, for 26 stations, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891-92, pp. 26 and 30.

Table VII gives, for about 130 stations, the arithmetical

means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891-92, p. 19.

Table VIII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division one may obtain the average resultant direction for that division.

Table IX gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table X gives, for 56 stations, the percentages of hourly sunshine as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table XI gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XII gives the record of excessive precipitation at all stations from which reports are received.

**NOTES EXPLANATORY OF THE CHARTS.**

Chart I.—Tracks of centers of high pressure. The roman letters show number and order of centers of high areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the highest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a ridge of high pressure.

Chart II.—Tracks of centers of low pressure. The roman letters show number and order of centers of low areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the lowest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a trough or long oval area of low pressure.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level isobars, surface isotherms, and resultant winds. The wind directions on this Chart are the computed resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are not reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and correspond to Professor Hazen's system of reduction; the barometer is not reduced to standard gravity, but the necessary reduction for 30 inches of the mercurial barometer is shown by the marginal figures for each degree of latitude.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Total snowfall in inches and limits of freezing weather.

Chart VII.—Depth of snow on ground at the close of the month.

























TABLE III.—*Data from Canadian stations for the month of December, 1897.*

Stations.	Pressure.			Temperature.		Precipitation.		Prevailing direction of wind.	Total depth of snow.
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Total.	Departure from normal.		
St. Johns, N. F. . .	Inches.	Inches.	Inches.	°	°	Inches.	Inches.	n.	22.0
Sydney, C. B. I. ....	29.56	29.71	-.13	29.4	+.07	5.07	.....	nw.	10.0
Hallifax, N. S. ....	29.88	29.94	+.06	29.4	+.12	2.54	— 2.18	nw.	1.9
Grand Manan, N. B. ....	29.94	29.99	+.07	29.4	+.18	3.53	— 1.76	nw.	5.1
Yarmouth, N. S. ....	29.84	30.02	+.04	28.1	+.14	2.08	— 3.19	nw.	5.7
Charlottet' n, P. E. I. ....	29.90	29.94	+.02	26.2	+.19	2.47	— 1.58	nw.	6.5
Chatham, N. B. ....	29.98	29.95	+.01	19.0	+.20	3.39	+.042	w.	19.6
Father Point, Que. ....	29.96	29.99	+.04	16.8	+.12	3.05	+.083	w.	18.4
Quebec, Que. ....	29.67	20.03	— .01	16.4	+.12	2.37	— 1.94	ne.	12.3
Montreal, Que. ....	29.80	30.02	— .01	19.2	+.09	5.94	+.238	sw.	39.1
Rockliffe, Ont. ....	29.47	30.02	— .01	18.4	+.18	4.43	+.169	se.	32.3
Kingston, Ont. ....	29.70	30.04	— .01	25.0	+.13	3.32	— 0.32	w.	....
Toronto, Ont. ....	29.64	30.04	— .02	27.8	+.08	8.68	+.14	sw.	13.3
White River, Ont. ....	29.60	30.06	— .01	3.6	— 6.1	0.92	— 0.52	w.	9.2
Port Stanley, Ont. ....	29.38	30.05	— .02	28.0	— 0.4	2.45	— 0.16	w.	12.0
Saugeen, Ont. ....	29.20	30.01	— .01	27.2	+.05	4.77	+.064	nw.	34.3
Parry Sound, Ont. ....	29.26	30.00	— .03	21.4	+.02	6.30	+.237	e.	46.8
Port Arthur, Ont. ....	29.38	30.03	— .01	10.5	— 2.7	0.46	— 0.29	nw.	4.6
Winnipeg, Man. ....	29.14	30.04	— .06	3.0	— 1.1	0.55	— 0.64	w.	5.4
Minnedosa, Man. ....	29.09	30.05	— .05	3.6	— 2.1	0.94	+.21	w.	9.3
Qu'Appelle, Assin. ....	27.62	30.05	— .07	5.8	— 1.6	0.43	— 0.21	nw.	4.3
Medicine Hat, Assin. ....	27.64	30.07	— .08	18.0	— 0.3	0.43	— 0.07	s.	4.2
Swift Curr't, Assin. ....	27.34	30.08	— .04	14.2	— 1.8	0.89	— 0.18	w.	8.9
Calgary, Alberta. ....	26.31	30.03	— .10	17.8	— 0.4	0.70	— 0.08	w.	7.0
Prince Albert, Sask. ....	29.98	30.00	....	4.2	+.14	2.10	.....	nw.	21.0
Edmonton, Alberta. ....	27.55	30.02	— .08	15.5	— 2.4	1.04	— 0.64	w.	5.4
Battleford, Sask. ....	29.16	30.04	....	4.4	— 1.0	0.50	.....	se.	4.0
Kamloops, B. C. ....	.....	.....	.....	.....	.....	1.23	.....	.....	10.0
Hamilton, Bermuda. ....	30.00	30.16	+.04	65.8	— 1.1	3.86	.....	e.	....
Banff, Alberta. ....	29.38	30.14	....	15.9	.....	0.98	.....	sw.	6.2
Esquimalt, B. C. ....	30.01	30.04	.....	40.8	— 0.5	10.85	.....	n.	0.0
Ottawa, Ont. ....	29.69	30.07	....	10.6	— 0.4	4.18	.....	w.	....
November, 1897.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Calgary, Alberta. ....	29.98	30.15	— .11	10.6	— 15.2	2.54	— 2.10	w.	....

TABLE IV not received.















